Ocean University of China

Ocean Monitoring and Inspection Center

Monitoring (Inspection) Report

OUC (Testing) No. HDJC2010-002

Client: Qingdao Headway Technology Co., Ltd.

Project Name: Shipboard Testing of OceanGuard™ Ballast Water Management System

Inspection Dept.: Marine Chemistry Analysis and Detection Laboratory

Approved by: 宋沃

Date of issue: 01/26/2010

Inspected by.: Ocean Monitoring and Inspection Center,

Ocean University of China (Official Seal)

STATEMENT

1. The report is invalid without the official seal of Ocean Monitoring and Inspection Center, Ocean University of China (hereinafter referred to as the Center).
2. Copy of the report is invalid without the original seal of the Center.
3. The report is invalid without signature of test operator, verifier, and authorizer.
4. The report is invalid with any alteration.
5. Should any dissidence arisen on the Test Report, please contact the Center within thirty days after receiving the report. An overdue submission of any complains will be disregarded.
6. If the samples were sent to the Center by the client, the Center is only responsible for the testing results, but not for the source of the samples,.
7. Test results are valid only for the same batch of samples.
8. Copy of test reports is not allowed without written permission of the Center.
9. This report is in decuplicate, with five for English version and five for Chinese version. For each version, two original copies and one duplicate will be sent to the Client, two duplicates will be kept at the Center and the inspection department (laboratory) respectively for documentation.

To improve our testing capability and service quality continuously and to better serve clients and the community, comments from all sectors of the community to the Center are warmly welcome.

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Project Description

Entrusted by Qingdao Headway Technology Co., Ltd., the project comprises tests on physical, chemical and biological parameters of ballast water treated by OceanGuard™ Ballast Water Management System installed on SITC YOKOHAMA, and gas parameters of air in ballast tanks during ballasting and deballasting process. Ocean Monitoring and Inspection Center, Ocean University of China acts as the implementation party of the project, and accredited staffs of the Center were appointed to the test sites to supervise the operation of the whole process and to carry out sampling and on-site inspection as required. Off-site testing samples were delivered to specified laboratories of the Center and tested by accredited staffs within a specified time region. The ballasting process was under supervision of CCS Qingdao Branch, and the deballasting under DNV supervision.

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Name of project	Shipboard Testing of OceanGuard™ Ballast Water Management System
Client	Name: Qingdao Headway Technology Co., Ltd. Add: Huite Industrial City, Zhuzhou Road, Qingdao, China Tel: 0532-88702808

	No.	Item	Sample container	Collected volume	Preservation	Expected storage time
Sampling and Storage	1	Temperature	Plastic bottle	1 L	Test on site	——
	2	Salinity			Test on site	——
	3	TRO	Plastic bottle	1 L	Test on site	——
	4	POC	Pretreated plastic bottle	2 L	4 ℃	≤7 days
	5	DOC				
	6	TSS	Pretreated plastic bottle	1 L	4 ℃	≤24 hrs
	7	Organisms ≥50 μm	Sterile plastic bottle	1 m^3	Test on site	≤6 hrs
	8	Organisms ≥10-50 μm	Sterile plastic bottle	1 L	4 ℃	≤24 hrs
	9	Heterotrophic bacteria	Sterile plastic bottle	500 mL	4 ℃	≤24 hrs
	10	*E. coli*				
	11	*Vibrio cholera*				
	12	Enterococcus group bacteria				
	13	CO	——	——	Test on site	——
	14	H_2S				
	15	O_2				
	16	H_2				
	17	Cl_2				
	18	CH_4				

Test operator: Verifier: Authorizer:

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	No.	Item	Method	Major instrument
Testing method and major instrument	1	Temperature	Sensor detection	VICTOR TP01
	2	Salinity	Sensor detection	HOTEC SC-106
	3	TRO	DPD	HACH DR/2800
	4	POC	Catalytic combustion	SHIMADZU TOC-V_{cpn}
	5	DOC	Catalytic combustion	SHIMADZU TOC-V_{cpn}
	6	TSS	Weighting	DDG-9203 Electric Blast Drying Oven METTLER TOLEDO EL104 Balance
	7	Organisms≥50 μm	Microscope determination	OPTEC SMJ-T2 Stereo Microscope
	8	Organisms ≥10-50 μm	CFDA Most Probable Numbering (MPN)	Leica OMLA Fluorescence Microscope YUE FENG SPX-150 Low-temperature Incubator
	9	Heterotrophic bacteria	Plate counting	YUE FENG SPX-150 Low-temperature Incubator
	10	*E. coli*	Counting after membrane filtration	YUE FENG SPX-150 Low-temperature Incubator
	11	Enterococcus group bacteria	Counting after membrane filtration	YUE FENG SPX-150 Low-temperature Incubator
	12	*Vibrio cholera*	Counting after membrane filtration	YUE FENG SPX-150 Low-temperature Incubator
	13	CO	Sensor detection	HAN WEI BX618 Gas Detector
	14	H_2S	Sensor detection	HAN WEI BX618 Gas Detector
	15	O_2	Sensor detection	HAN WEI BX618 Gas Detector
	16	H_2	Sensor detection	HAN WEI BX170 Gas Detector
	17	Cl_2	Sensor detection	HAN WEI BX170 Gas Detector
	18	CH_4	Sensor detection	HAN WEI BX618 Gas Detector

Testing results	See attachment			
Laboratory Environment	Temperature	19.0 ℃	Humidity	70 %

Test operator: [signature] Verifier: [signature] Authorizer: [signature]

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(Attachment)

Testing results of Cycle 1

1. Operation Condition

Name of the system: OceanGuard™ Ballast Water Management System

Manufacturer: Qingdao Headway Technology Co.,Ltd.

Testing Vessel: SITC YOKOHAMA

Cycle NO.: Cycle 1 Ballasting-Deballasting

Date: 2009/11/08—2009/11/17

Weather (Ballasting) : Sunny

Locus: Xia Men

Longitude: 118°04.873'E

Latitude: 24°31.275'N

Water Depth: 15.7 m

Weather (Deballasting): Sunny

Locus: Shanghai

Longitude: 121°38.978'E

Latitude: 31°20.410'N

Water Depth: 6.5 m

Test operator: Verifier: Authorizer:

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2. Operation Data

Table 1

Date	Process Description	Start Time	Stop Time	Average Flow Rate (m^3/h)
2009/11/08	Treated Water Ballasting	0:45	1:55	310.9
2009/11/08	Control Water Ballasting	2:15	3:45	319.9
2009/11/17	Treated Water Deballasting	6:00	7:05	312.4
2009/11/17	Control Water Deballasting	7:30	9:00	320.2

Test operator: Verifier: Authorizer:

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3. Testing Results

Table 2 Water Quality and Biological Testing Results During Ballasting

Item	Influent Water	Treated Water During Ballasting	Control Water During Ballasting
Temperature (° C)	25.0±0.2	25.2±0.1	25.2±0.2
Salinity (PSU)	30.2±0.2	30.3±0.1	30.2±0.1
TRO (mg/L)	0.00±0.00	1.95±0.02	0.00±0.00
POC (mg/L)	0.61±0.11	0.64±0.11	0.80±0.15
DOC (mg/L)	1.33±0.16	0.97±0.13	1.17±0.11
TSS (mg/l)	31.8±1.00	16.3±9.57	25.47±7.66
Organisms ≥50 μm (/m^3)	3214±350	0.0±0.0	2905±149
Organisms ≥10-50 μm (CFDA)	322.3±24.1 /mL	5.7±2.5 /L	303±14.9 /mL
Organisms ≥10-50 μm (MPN)	240.0±34.6 /mL	5.5±3.0 /L	203.3±28.9 /mL
Heterotrophic bacteria (cfu/100 mL)	$(8.69\pm2.76)\times10^4$	$(7.76\pm5.44)\times10^2$	$(1.41\pm0.85)\times10^5$
E. coli (cfu/100 mL)	230.0±7.0	0.0±0.0	79.3±19.4
Enterococcus group bacteria (cfu/100 mL)	42.3±21.6	0.0±0.0	35.0±23.1
Vibrio cholera (cfu/100 mL)	0.67±0.58	0.0±0.0	0.53±0.57

Test operator: Verifier: Authorizer:

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Table 3 Water Quality and Biological Testing Results During Deballasting

Item	Treated Water During Deballasting (1)	Treated Water During Deballasting (2)	Treated Water During Deballasting (3)	Control Water During Deballasting
Temperature (^{o}C)	26.7±0.8	26.8±1.7	26.9±1.0	26.9±1.0
Salinity (PSU)	30.0±0.1	30.2±0.2	30.2±0.2	30.2±0.1
TRO (mg/L)	0.01±0.01	0.01±0.01	0.01±0.01	0.00±0.00
POC (mg/L)	0.97±0.05	1.03±0.05	0.80±0.03	0.96±0.29
DOC (mg/L)	0.94±0.12	0.85±0.07	0.91±0.16	1.09±0.25
TSS (mg/L)	14.3±1.8	14.2±2.8	12.9±0.9	25.5±2.7
Organisms≥50 μm (/m^3)	0.0±0.0	0.0±0.0	0.0±0.0	3083±190
Organisms ≥10-50 μm (CFDA)	2.0±1.0 /L	1.0±1.0 /L	0.7±0.6 /L	312.3±15.2 /mL
Organisms ≥10-50 μm (MPN)	3.1±2.0 /L	1.8±1.8 /L	2.4±2.8 /L	326.7±40.4 /mL
Heterotrophic bacteria (cfu/100 mL)	(5.90± 1.65)×10^2	(4.86±1.11)×10^2	(2.43±1.18)×10^2	(2.35± 1.36)×10^5
E. coli (cfu/100 mL)	0.0±0.0	0.0±0.0	0.0±0.0	95.3±12.2
Enterococcus group bacteria (cfu/100 mL)	1.0±1.0	0.3±0.5	0.7±1.1	284.3±80.1
Vibrio cholera (cfu/100 mL)	0.0±0.0	0.0±0.0	0.0±0.0	0.5±0.5

Test operator: 田林 赵丽园 Verifier: 祁陆奇 Authorizer: 李先国

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(Attachment)

Table 4 Results of Gas Measurement

Process Description	Sampling Place	CO (ppm)	H_2S (ppm)	O_2 (%)	H_2 (%LEL)	Cl_2 (ppm)	CH_4 (%LEL)
Ballasting	Treated Tank	0-12	0	20.9	0	0	0
	Control Tank	0	0	20.9	0	0	0
6hrs after ballasting	Treated Tank	3	0	20.9	0	0	0
12hrs after ballasting	Treated Tank	0	0	20.9	0	0	0
Deballasting	Treated Tank	0	0	20.9	0	0	0
	Control Tank	0	0	20.9	0	0	0

Table 5 Results of TRO Measurement

Units：mg/L

Ballasting		6hrs after ballasting	12hrs after ballasting	Deballasting	
Treated Tank	Control Tank	Treated Tank	Treated Tank	Treated Tank	Control Tank
1.95±0.02	0.00±0.00	0.46	0.19	0.01±0.01	0.00±0.00

Test operator: Verifier: Authorizer: